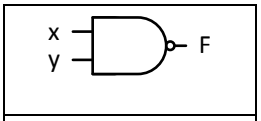
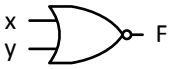
HOMEWORK II DUE: 02 November 2017

1. Identify each of these logic gates by name, and complete their respective truth tables:



Name:

x	y	F
0	0	1
0	1	1
1	0	1
1	1	0

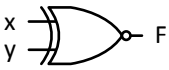


Name:

x	y	F
0	0	1
0	1	0
1	0	0
1	1	0

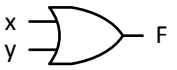
Name:

x	y	F
0	0	0
0	1	0
1	0	0
1	1	1



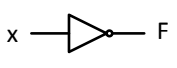
Name:

x	y	F
0	0	1
0	1	0
1	0	0
1	1	1



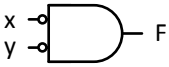
Name:

x	y	F
0	0	0
0	1	1
1	0	1
1	1	1



Name:

x	F
0	1
1	0

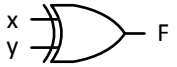


Name:

x	y	F
0	0	1
0	1	0
1	0	0
1	1	0

Name:

x	y	F
0	0	1
0	1	1
1	0	1
1	1	0



Name:

x	y	F
0	0	0
0	1	1
1	0	1
1	1	0

(10 pts)

2. Use algebraic manipulation to simplify the following expression

a. F(A,B,C) = A' + ABC + A(B⊕C) + AB'C'

F = A' + ABC + A(B⊕C) + AB'C'

= A' + ABC + AB'C + ABC' + AB'C'

= A' + AB(C+C') + AB'(C+C')

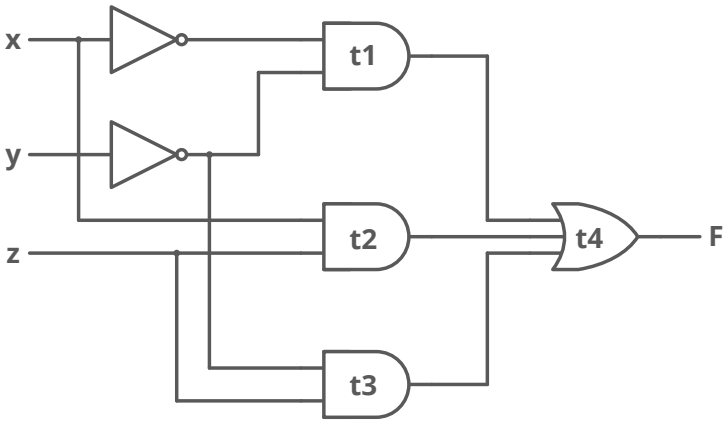
= A' + AB + AB'

= A' + A (B+B')

= A' + A = 1

(10 pts)

3. Convert the following logic gate circuit into a Boolean expression. Write Boolean sub-expression next to each gate.



(10 pts)

t1 = x'.y', t2 = x.z, t3 = y'z

F = x'y' + x.z + y'z

4. Use DeMorgan's Theorems to simplify the following expressions:

F = (B'D) (A' + C'D) + (BC'+D'A)

F = [(B'D) (A' + C'D) + (BC'+D'A)]'

F = (B'D)' + (A'+C'D)' (BC'+D'A)'

F = (B+D') + A(C+D') (B'+C)(D+A')

(5 pts)

5. Without simplification, write the expressions for F(dual) and F'(complement) corresponding to the Boolean function:

F = A + 0.B'(C'+1.D)

F(dual) = A(1+B'+(C'(0+D)))

F' = A'(1+B+(C(0+D')))

(5 pts)

6. A Boolean function F defined on the three input variables **x**, **y** and **z** is **1** if and only if number of **1(one)** input is **even**. (e.g., F is 1 if x = 1, y = 0, z = 1). Draw the truth table for the above functions and express it in canonical sum-of-products and product-of-sums form.
(10 pts)

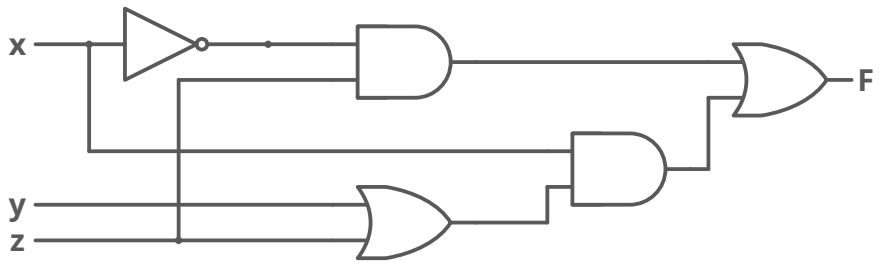
x	y	z	F_1
0	0	0	**1**
0	0	1	**0**
0	1	0	**0**
0	1	1	**1**
1	0	0	**0**
1	0	1	**1**
1	1	0	**1**
1	1	1	**0**

$F = x'y'z' + x'yz + xy'z + xyz' = m_0 + m_3 + m_5 + m_6$
$F(x,y,z) = \sum(0,3,5,6)$

7. Draw the logic diagram for the following Boolean expression

F = x'z + x (y+z)

(10 pts)



8. Obtain the truth table of the following functions, and express each function in sum-of-minterms and product-of-maxterms form:

bd' + acd' + ab'c + a'c'

a	b	c	d	a'	b'	c'	d'	bd'	acd'	ab'c	a'c'	F
0	0	0	0	1	1	1	1	**0**	**0**	**0**	**1**	**1**
0	0	0	1	1	1	1	0	**0**	**0**	**0**	**1**	**1**
0	0	1	0	1	1	0	1	**0**	**0**	**0**	**0**	**0**
0	0	1	1	1	1	0	0	**0**	**0**	**0**	**0**	**0**
0	1	0	0	1	0	1	1	**1**	**0**	**0**	**1**	**1**
0	1	0	1	1	0	1	0	**0**	**0**	**0**	**1**	**1**
0	1	1	0	1	0	0	1	**1**	**0**	**0**	**0**	**1**
0	1	1	1	1	0	0	0	**0**	**0**	**0**	**0**	**0**
1	0	0	0	0	1	1	1	**0**	**0**	**0**	**0**	**0**
1	0	0	1	0	1	1	0	**0**	**0**	**0**	**0**	**0**
1	0	1	0	0	1	0	1	**0**	**1**	**1**	**0**	**1**
1	0	1	1	0	1	0	0	**0**	**0**	**1**	**0**	**1**
1	1	0	0	0	0	1	1	**1**	**0**	**0**	**0**	**1**
1	1	0	1	0	0	1	0	**0**	**0**	**0**	**0**	**0**
1	1	1	0	0	0	0	1	**1**	**1**	**0**	**0**	**1**
1	1	1	1	0	0	0	0	**0**	**0**	**0**	**0**	**0**

F (a,b,c,d) $= \sum (0,1,4,5,6,10,11,12,14)$

F (a,b,c,d) $= \prod (2,3,7,8,9,13,15)$

(10 pts)

9. For the Boolean function

F = xy'z + x'y'z + w'xy + wx'y + wxy

a. Obtain the truth table of **F**.

b. Draw the logic diagram, using the original Boolean expression.

c. Use Boolean algebra to simplify the function to a minimum number of literals.

d. Obtain the truth table of the function from the simplified expression and show that it is the same as the one in part (*a*).

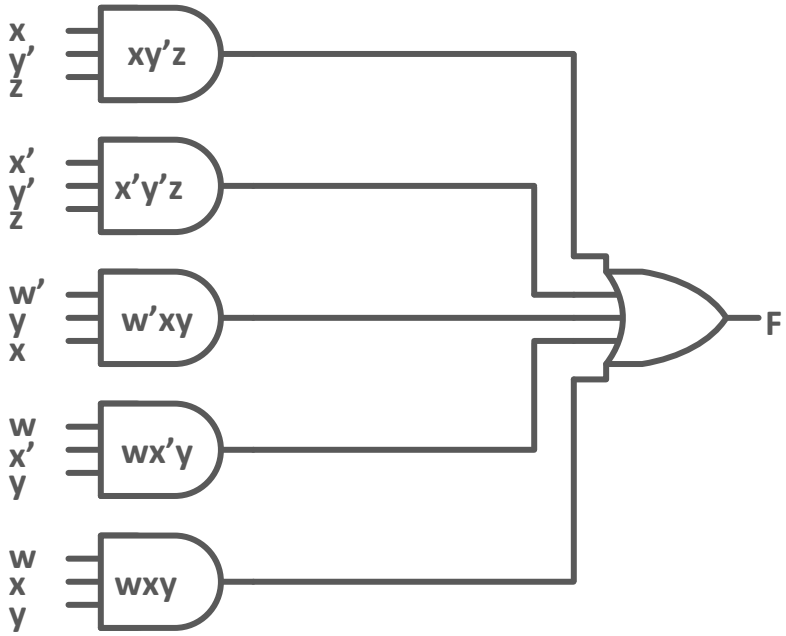
e. Draw the logic diagram from the simplified expression, and compare the total number of gates with the diagram of part (*b*).

(25 pts)

a.

w	x	y	z	w'	x'	y'	z'	xy'z	x'y'z	w'xy	wx'y	wxy	F
0	0	0	0	1	1	1	1	0	0	0	0	0	**0**
0	0	0	1	1	1	1	0	0	1	0	0	0	**1**
0	0	1	0	1	1	0	1	0	0	0	0	0	**0**
0	0	1	1	1	1	0	0	0	0	0	0	0	**0**
0	1	0	0	1	0	1	1	0	0	0	0	0	**0**
0	1	0	1	1	0	1	0	1	0	0	0	0	**1**
0	1	1	0	1	0	0	1	0	0	1	0	0	**1**
0	1	1	1	1	0	0	0	0	0	1	0	0	**1**
1	0	0	0	0	1	1	1	0	0	0	0	0	**0**
1	0	0	1	0	1	1	0	0	1	0	0	0	**1**
1	0	1	0	0	1	0	1	0	0	0	1	0	**1**
1	0	1	1	0	1	0	0	0	0	0	1	0	**1**
1	1	0	0	0	0	1	1	0	0	0	0	0	**0**
1	1	0	1	0	0	1	0	1	0	0	0	0	**1**
1	1	1	0	0	0	0	1	0	0	0	0	1	**1**
1	1	1	1	0	0	0	0	0	0	0	0	1	**1**

b.



c. **F = xy'z + x'y'z + w'xy + wx'y + wxy**

F = y'z(x + x') + w'xy + wy(x'+ x)

F = y'z + w'xy+wy

F = y'z + y(w'x+w)

F = y'z + y[(w'+w)(w+x)]

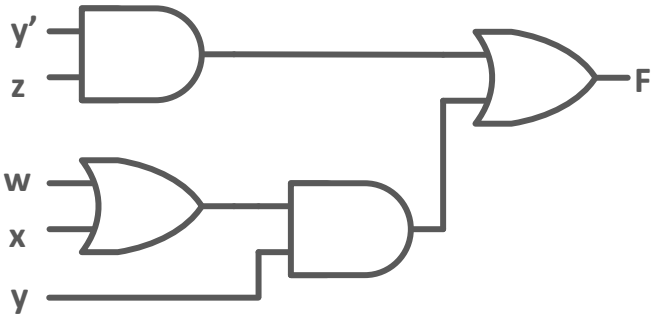
F = y'z + y(w+x)

d.

w	x	y	z	w'	x'	y'	z'	y'z	w+x	y(w+x)	F
0	0	0	0	1	1	1	1	0	0	0	**0**
0	0	0	1	1	1	1	0	1	0	0	**1**
0	0	1	0	1	1	0	1	0	0	0	**0**
0	0	1	1	1	1	0	0	0	0	0	**0**
0	1	0	0	1	0	1	1	0	1	0	**0**
0	1	0	1	1	0	1	0	1	1	0	**1**
0	1	1	0	1	0	0	1	0	1	1	**1**
0	1	1	1	1	0	0	0	0	1	1	**1**
1	0	0	0	0	1	1	1	0	1	0	**0**
1	0	0	1	0	1	1	0	1	1	0	**1**
1	0	1	0	0	1	0	1	0	1	1	**1**

1	0	1	1	0	1	0	0	0	1	1	**1**
1	1	0	0	0	0	1	1	0	1	0	**0**
1	1	0	1	0	0	1	0	1	1	0	**1**
1	1	1	0	0	0	0	1	0	1	1	**1**
1	1	1	1	0	0	0	0	0	1	1	**1**

e.



10. Convert the following to the other canonical form:

a. F (x,y,z) = $\sum$ (2,3,5,6)

F (x,y,z) = $\prod$ (0,1,4,7)

b. F (x,y,z) = $\prod$ (0,2,4,5,7)

F (x,y,z) = $\sum$ (1,3,6)

(5 pts)